# Blade assembly especially for an ice auger or like

The invention relates to a blade assembly, especially for an ice auger or the like, comprising a shank and a bit head. The shank is provided at least with elements for mounting the bit head. The bit head, in turn, includes one or more disk-shaped bit members, which rotate during a drilling/boring operation and which have an outer rim thereof working as an actual cutting face in drilling/boring.

Traditionally, the ice auger consists of three components, i.e. an actual auger element, a crank at its top end, and a blade assembly at its bottom end, respectively. Such traditional ice augers comprise generally a helical structure and the blade assembly used therein comprises bit members, which are mounted either fixedly or removably to the auger element, yet absolutely immobilized when in use.

The bit members used in this context are generally metal pieces of a parallelogram shape, having one of the long sides thereof beveled to serve as a blade or bit. The blade assembly of an ice auger is generally provided with two of such bit members, which are inclined relative to the auger's centre axis. As a result of the inclination angle, the auger is focused at a single point on ice as boring is started. The incidence angle, on the other hand, is important in terms of what is called engaging capacity or "biting ability" of the auger.

The engaging capacity of a traditional fixed auger head including two bit members depends essentially on the acuteness of bit angles. The inner edge, in particular, is exposed to high stress and is highly susceptible to wearing and chipping in use. When this happens, the boring becomes

unreasonably strenuous and, thus, the bits must be sharpened. Accordingly, in the event that an auger has been left lying on the ice, there is always a risk of a person's foot hitting the exposed blade as the outer edges of a traditional auger bit are particularly hazardous. In practice, another hazardous operation is the placement of a blade cover. In addition, the blade or bit head of a traditional ice auger requires constant adjustment as the composition of ice varies e.g. along with air temperature; an excessively engaging edge, effective in terms of cutting dry and hard ice, becomes stuck in sloshy soft ice. The only way of adjusting such a traditional fixedly secured bit is by grinding its beveled edge.

On the other hand, it is prior known from patents US 1,719,546 and US 2,713,993 to beneficially provide a blade assembly with a disk-shaped bit member rotating during a drilling operation and having its outer rim working as an actual cutting face. The above-cited solutions are intended specifically for ground boring or e.g. rock drilling. In the cited solutions, the bit members or disks are disposed in an almost vertical position against a drilled surface, which is why, on the basis of experience, such solutions are by no means applicable to ice drilling/boring.

It is an object of a blade assembly according to the present invention to provide a decisive improvement regarding the foregoing problems and thereby to raise substantially the existing state of the art. In order to fulfil this objective, a blade assembly of the invention is principally characterized in that the rotating bit member included in the bit head is disposed at an angle of less than 45° relative to a drilled surface.

As the most important benefits gained by a blade assembly of the invention should be mentioned simplicity, efficiency and safety with regard to its construction, manufacture and operation. The inventive blade assembly, which comprises a bit member circular in shape and rotating in a drilling process, as well as disposed at a suitably low angle relative to a drilled surface, makes a smooth contact with the ice to be bored, as just a small portion thereof is parallel to the radius of a bored hole. By virtue of this, boring is quite effortless and the bit does not get jammed in ice. On the other hand, the bit member included in a blade assembly of the invention rotates steadily in use, nor does it develop chipped edges or the like defects. Even if the bevel of a bit member should become damaged at some point, the biting performance shall not be significantly impaired in practice since the bit rotates continuously in a drilling operation and turns the dull point quickly away from the cutting position. All in all, the inventive blade assembly is highly adaptable to mass production, including even automated production. Another major benefit gained by the inventive blade assembly lies in the fact that the incidence angle of a bit member can be adjusted e.g. by tightening or loosening attachment of the bit or by having it mounted on the blade assembly's shank preferably in a flexible manner.

Preferred embodiments for a blade assembly of the invention are set forth in the relevant dependent claims.

The invention will be described in detail in the following specification with reference to the accompanying drawings, in which

fig. 1

shows a traditional auger bit member (t), provided with a beveled edge (v) and an attachment hole (R),

fig. 2

shows a pair of traditional bit members for an ice auger in operative position seen from above,

fig. 3

shows both a section at 1-1 in fig. 2, depicting an inclination angle formed by each bit member, and a section at 2-2 in fig. 2, depicting a cutting/incidence angle formed by each bit member,

fig. 4

shows a bit member included in a blade assembly of the invention, in a plan view and in a side view,

fig. 5

shows a pair of bit members included in a blade assembly of the invention, in a plan view, as well as in side views depicting an inclination angle and a cutting/incidence angle,

fig. 6

shows a blade assembly of the invention, having bit members coupled by a cotter pin, a fastening screw and nut to a shank of the blade assembly,

fig. 7

shows a side view of a blade assembly alternative to fig. 6, having each bit member coupled by a

separate connecting member to substantially horizontally extending arm elements of the shank,

fig. 8

shows an integrally built body element included in the shank of a blade assembly of the invention, in a plan view, a front view, and a side view,

fig. 9

shows a bit member alternative to fig. 4, in views depicting especially one preferred way of manufacturing the same, and

fig. 10

shows an embodiment alternative to the blade assembly of figs. 6 and 7, comprising a single rotary bit member.

The invention relates a blade assembly, especially for an ice auger or the like, comprising a shank 1 and a bit head 2. The shank 1 is provided at least with elements 3 for mounting the bit head 2. The bit head 2, in turn, includes one or more disk-shaped bit members 2a, which rotate w during a drilling/boring operation and which have an outer rim 2a' thereof working as an actual cutting face in drilling/boring. The rotary bit member 2a included in the bit head is disposed, as depicted e.g. in fig. 5, at an angle of less than 45° relative to a drilled surface A.

The blade assembly's shank 1 comprises preferably a structure, which projects in two or more directions and which has the bit members 2a included in the bit head 2 mounted on its arm elements in a dismountable fashion, such as by using a screw connection or the like. Arm elements 1a, projecting laterally from the shank 1 in a

substantially horizontal plane, are shaped, as depicted e.g. in figs. 6, 7 and 8, such that the angle a of each bit member 2a, such as its inclination angle a1, incidence/cutting angle a2 and/or the like, lies within the range of 5-30° relative to the drilled surface A.

Fig. 10 illustrates a solution alternative with respect to what is described above, comprising just one rotary bit member 2a which is mounted on the arm element 1a projecting from the shank 1. In this solution, the alignment of a blade assembly and the drilling of a pilot hole are performed by means of a central drill CD present at an end of the shank element 1. Also in this solution, the rotary bit member 2a is provided with angular settings as described above, yet having its inclination in the opposite direction so as to perform its drilling action by the outer edge of the rotary bit member 2a as opposed to performing it with the inner edge of the rotary bit member 2a, as in the solutions of figs. 6 and 7.

In the solution shown in fig. 10, a pilot hole is drilled by the twist bit CD used as a central drill and the outer rim for a hole to be bored/drilled is in turn drilled by the rotary bit member 2a. A solution like this enables a very neat drilling result. In addition, it is highly suitable for a motor-driven auger as it can be used for making holes side by side quite close to each other, the central drill CD being effective in blocking lateral slipping.

In a further preferred embodiment, one or more bit members 2a included in the bit head 2 are provided with means 4 for enhancing the drilling action, such as a corrugation, a serration and/or the like, present on its cutting face 2a', as depicted e.g. in fig. 9. On the other hand, in yet another

preferred embodiment, each bit member 2a included in the bit head is made of tempered steel, at least in its cutting face 2a'.

Especially in reference to fig. 5, the bit member 2a included in the bit head 2 has an inclination angle a; a1 preferably of 14,5° and/or respectively an incidence/cutting angle a; a2 preferably of 15°.

In a further preferred embodiment, the blade assembly has its shank 1 provided with means 5 for adjusting the distance of one or more bit members 2a with respect to a centre axis k of the shank 1. In practice, the bit members have an adjusting range which is preferably about 25 mm, whereby an auger of e.g. 110 mm has a maximum capacity of making 135 mm holes.

In a preferred practical embodiment, referring particularly to fig. 8, the above-mentioned means 5 are established by means of elongated attachment holes 3a present in a shank element 1; 1a", included in the shank and comprising two integrally built arm elements.

In still another preferred embodiment, one or more bit members 2a included in the bit head 2 are adapted to have a flexible attachment to the shank 1, specifically for enabling self-adjustment of its cutting angle a; a2. In the solution of fig. 7, for example, the arrangement like this is feasible by providing the bit members 2a with a recess, in which a fastening screw, for example of the cap bolt type, is countersinkable by fitting e.g. a spring washer between its head and the bottom of the recess included in the bit member. This is followed by securing the bit member in a hole R present in the shank's arm element 1; 1a by using for example a spacer member 3; 3b of the type shown in fig.

7 and by locking e.g. a clamping screw or a locking stud e.g. by means of a nut, a cotter pin, a wingnut and/or the like. The spring washer, fitted as described above between the bit member and the head of a clamping screw or a suitable locking stud, allows for the bit member a small clearance. Thus, with a high pressure applied to the bit member, e.g. in the process of boring thick or sloshy ice, the result is a shade smaller cutting angle for the bit member and a reduced thickness for cuttings, the boring becoming lighter towards the end of hole-making as opposed to what happens in traditional boring.

As an option to the bit member shown in fig. 4, which is made from a block of metal with equal all-round thickness, the bit member 2a included in the bit head 2 is feasible to manufacture in 1,5-3,5 mm gauge sheet steel, which is formed with the cutting face 2a' and/or the means 4 for enhanced drilling by die cutting or the like manner and in which a bevel for the bit member's cutting face 2a' is surface ground to an angle c preferably of about 25°.

It is possible to manufacture the above type of bit member in the principle shown e.g. in fig. 9, such that the sheet metal is first cut for a circular bit panel $2a_1$ , which is then punched for the edge serration 4, the central hole R, as well as an edge bevel X. This is followed by surface grinding a bit member panel $2a_0$ over its bottom surface for providing a bit member 2a with a sharp cutting edge 2a'.

It is obvious that the invention is not limited to the embodiments illustrated or described above, but a multitude of most diverse variations can be made therein within the scope of the basic inventive concept. Thus, first of all, it is evident that the shank element, which

is an integral part of the blade assembly, is feasible for being manufactured from the most diverse of materials by applying the most diverse of manufacturing techniques. Furthermore, the number of arm elements included therein can be more than presented above, which are nevertheless preferably arranged symmetrically due to the intended application. Still further, the embodiment with a single rotary bit member, as described above as an option, can also be naturally implemented so as to include several arm elements. In this solution, it is also possible, instead of a solution integrated with the blade assembly's shank as depicted in a view of principle in fig. 10, to implement the central element used for drilling a central hole by applying appropriate quick-action couplings, such as e.g. locking stud and cotter pin arrangements, a threaded connection, a bayonet coupling or the like separate connectable bit member, which due to its intended application is preferably of a helical type but may also be of some other type. Furthermore, the coupling of a blade assembly to an ice auger can be implemented, as depicted in fig. 7, simply by means of a through-bore present in its attachment shaft, whereby it is connectable to the shank of the ice auger's helical element e.g. with a locking stud-cotter pin arrangement, a wingnut locking, or generally by means of any "quick coupling" arrangement. The coupling of a bit member rotatably to a shank element can also be implemented in a plurality of ways, whereby the bit member can have e.g. its central area made thicker than the rest of it, which enables the head of a coupling-effecting cap bolt or fastening stud to be countersunk completely therein. It is further possible to make the bit member e.g. disposable by using sheet metal therefor, whereby it requires no sharpening in use, being always readily replaceable with a new one. Naturally, instead of a spring washer, the adjustment of bit members can be accomplished

by flexible or other attachments enabling a slight tilting movement for the bit member. Respectively, the arrangement used for the distance of bit members can also be implemented, instead of an elongated hole, e.g. by means of a string of holes.